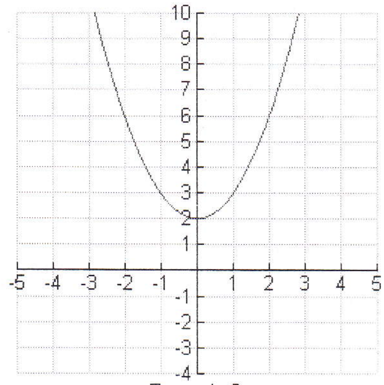
Review Part 1

1. For each relation, determine
    - the domain and range
    - whether or not it is a function. Explain why

a)



Example 2

b) $f(x) = x^2 + 6$

a) Function or Not a Function

D= $\{x \mid x \in R\}$

R= $\{y \mid y \geq 2, y \in R\}$

b) Function or Not a Function

D= $\{x \mid x \in R\}$

R= $\{y \mid y \geq 6\}$

2. *Given $f(x)=3x^2-3x+1$, evaluate $f(3)-f(-1)$*

$f(3) = 3(3)^2 - 3(3) + 1$
$= 19$

$f(-1) = 3(-1)^2 - 3(-1) + 1$
$= 7$

$= f(3) - f(1)$

$= 19 - 7$

$= 12$

3. Complete the following table.

Equation	Vertex	Axis of Symmetry	Domain	Range
$y = (x - 5)^2 + 1$	(5,1)	$x = 5$	$\{x \mid x \in R\}$	$\{y \mid y \geq 1\}$
$y = -2(x - 2)^2 + 6$	(2,6)	$x = 2$	$\{x \mid x \in R\}$	$\{y \mid y \leq 6\}$
$y = x^2 + 5$	(0,5)	$x = 0$	$\{x \mid x \in R\}$	$\{y \mid y \geq 5\}$
$y = 3(x - 3)^2 - 4$	(3,-4)	$x = 3$	$\{x \mid x \in R\}$	$\{y \mid y \geq -4\}$

4. The following transformations have been applied to the parent function $f(x) = x^2$:

A vertical stretch by a factor of 3
A horizontal shift 4 units to the left
A vertical shift 5 units up

Write the equation of this new function.

$f(x) = 3(x+4)^2 + 5$

5. A football is kicked from a height of 12 decimeters. The height of the football is modeled by the function $h(t) = -5t^2 + 30t + 12$, where t is time in seconds and h(t) is height in decimeters.

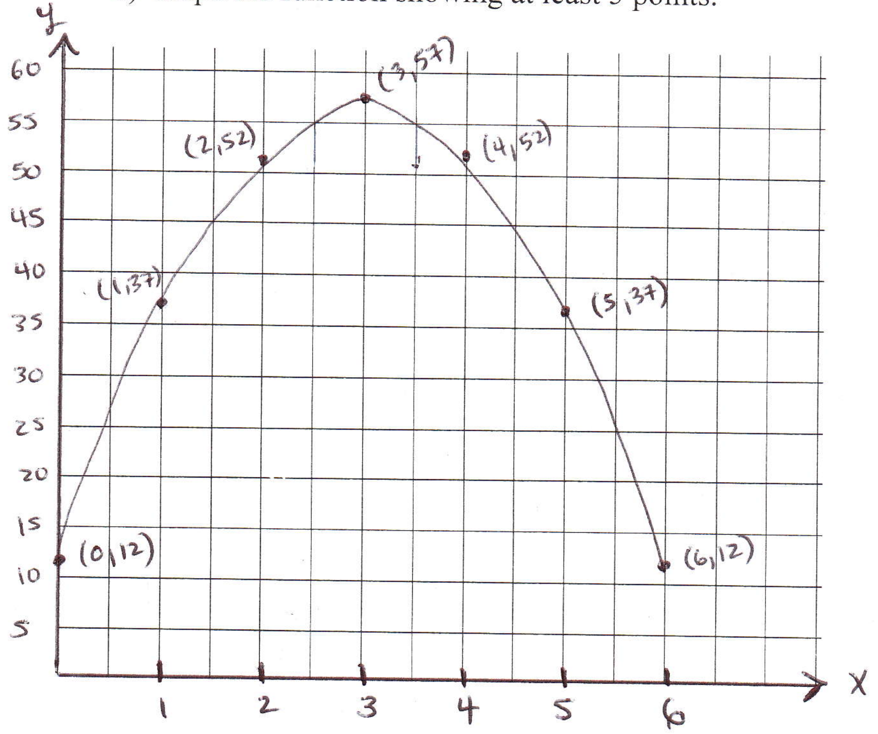
a) Express the above function in vertex form.
b) What is the maximum height of the football
c) At what time does the football reach the maximum height?
d) Graph the function showing at least 5 points.

a) $= -5(t^2 - 6t) + 12$
$= -5(t^2 - 6t + 9 - 9) + 12$
$= -5[(t-3)^2 - 9] + 12$
$= -5(t-3)^2 + 45 + 12$
$= -5(t-3)^2 + 57$

b) max height is 57 decimeters

c) reaches max height after 3secs

step pattern -5, -15, -25



6. A football is thrown into the air. The height, h(t), of the ball, in metres, after t seconds is modeled by $h(t) = -4.9(t-2.5)^2 + 9$.

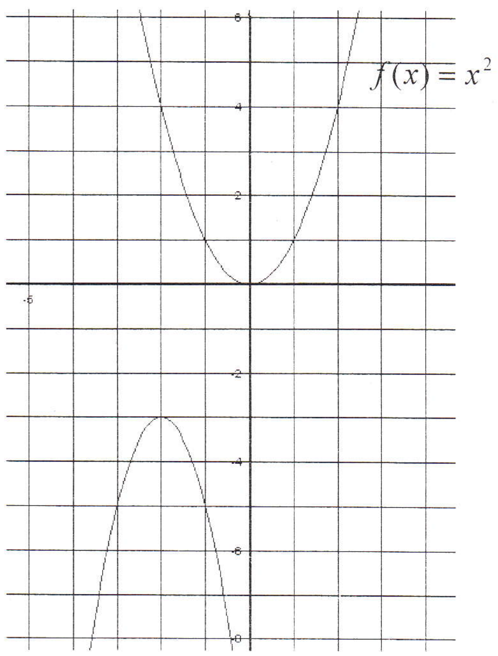
a) How high off the ground was the ball when it was thrown?
b) What was the maximum height of the football?
c) When does the ball hit the ground?

a) $t = 0$
$= -4.9(0-2.5)^2 + 9$
$= -21.625$

b) max height 9 metres

c) $0 = -4.9(t-2.5)^2 + 9$
$\frac{-9}{-4.9} = \frac{-4.9(t-2.5)^2}{-4.9}$
$\sqrt{1.83673} = \sqrt{(t-2.5)^2}$
$\pm 1.35526 = t - 2.5$
$t = 2.5 \pm 1.355261854$
$t = 3.86$ or $t = 1.14$
∴ the ball hits the ground after 3.86 secs

7. The graphs of $f(x) = x^2$ and another parabola are shown. Determine the equation for the second parabola.



$f(x) = -2(x+2)^2 - 3$

8. Fully factor each of the following expressions

a) $9y^2 - 36y^2$

$= 9(y^2 - 4y^2)$

$= 9(y-2y)(y+2y)$

b) $9y^2 - 6y$

$= 3y(3y-2)$

c) $2u^2 - 6uv + 4v^2$

$= 2(u^2 - 3uv + 2v^2)$

$= 2(u - 1v)(u - 2v)$

d) $16q^2 - 64$

$= 16(q^2 - 4)$

$= 16(q-2)(q+2)$

e) $4x^2 + 10x - 24$

M	A	N
-24	5	-8 3

$= 2(2x^2 + 5x - 12)$

$= 2(2x^2 - 8x + 3x - 12)$

$= 2[2x(x-4) + 3(x-4)]$

$= 2(2x+3)(x-4)$

f) $5a^2 - 17a - 12$

M	A	N
-60	-17	-20 +3

$= 5a^2 - 20a + 3a - 12$

$= 5a(a-4) + 3(a-4)$

$= (5a+3)(a-4)$

9. Determine the equation of the quadratic function that has a vertex of (2, -8) and passes through a point (1,0). Express your answer in factored form.

$y = a(x-2)^2 - 8$ sub(1,0) to solve a

$0 = a(1-2)^2 - 8$

$8 = a(-1)^2$

$\frac{8}{1} = \frac{1a}{1}$

$a = 8$

$y = 8(x-2)^2 - 8$

$= 8(x-2)(x-2) - 8$

$= 8(x^2 - 4x + 4) - 8$

$= 8x^2 - 32x + 32 - 8$

$= 8x^2 - 32x + 24$

10. Lina dives off a diving board into the water. Her height above the water after the dive is modeled by the function $h(t) = -t^2 + 2t + 35$, where $h(t)$ is the height in metres and t is time in seconds.

a) What is the height of the diving board?

∴ the height of the diving board is 35 metres.

b) When will Lina reach the water below the cliff?

$= -t^2 + 2t + 35$

$= -1(t^2 - 2t - 35)$ M A N: -35, -2, $-7\ +5$

$= -1(t - 7)(t + 5)$

OR

$t - 7 = 0$ $t + 5 = 0$

$t = 7$ $\boxed{t = -5}$ reject

∴ Lina reaches the water after 7 secs.

b) When will Lina reach a height that is 27 m above the water?

$27 = -t^2 + 2t + 35$

$0 = -t^2 + 2t + 35 - 27$

$= -t^2 + 2t + 8$

$= -1(t^2 - 2t - 8)$

$= -1(t + 2)(t - 4)$

OR

$t + 2 = 0$ $t - 4 = 0$

$\boxed{t = -2}$ reject $t = 4$

∴ Lina reaches a height of 27m after 4 seconds

11. Determine the zeros and the vertex for each function.

a) $h(x) = -2x^2 + x + 15$ M A N: -30, 1, $6\ -5$

$= -2x^2 + 6x - 5x + 15$

$= -2x(x - 3) - 5(x - 3)$

$= (-2x - 5)(x - 3)$

OR

$-2x - 5 = 0$ $x - 3 = 0$

$\frac{-2x}{-2} = \frac{5}{-2}$ $\boxed{x = 3}$

$\boxed{x = -2.5}$

AOS $= \frac{-2.5 + 3}{2}$

$x = 0.25$

sub $x = 0.25$

$= -2(0.25)^2 + (0.25) + 15$

$= 15.125$

Vertex $(0.25, 15.125)$

b) $f(x) = 2x^2 + 18x + 16$

$= 2(x^2 + 9x + 8)$

$= 2(x + 1)(x + 8)$

OR

$x = -1$ $x = -8$

AOS $= \frac{-1 - 8}{2}$

$x = \frac{-9}{2}$

$x = -4.5$

sub $x = -4.5$

$= 2(-4.5)^2 + 18(-4.5) + 16$

$= -24.5$

Vertex $(-4.5, -24.5)$